REMARKS

Under 35 USC § 103(a), claim 1 was rejected as obvious over Cipolla et al (US Pat. No. 5,268,815). Claims 2-11 were rejected under 35 USC § 103(a) as obvious over Cipolla et al (US Pat. No. 5,268,815) in view of Ali et al (US Pat. No. 6,188,576). Claims 12-20 were rejected under 35 USC § 103(a) as obvious over Cipolla et al (US Pat. No. 5,268,815).

Applicant appreciates the diagrams from the prior art that Examiner pasted into the office action with the added notation. This has helped Applicant to more precisely understand the rejection.

Cipolla Teaches a Closed-Top Design

Applicant has recognized the problem of blocked air flow caused by a closed-top design for a memory module heat sink:

> Some memory-module heat sinks feature a closed-top design that prevents air flow in the small gaps between the heat sink and the memory module substrate. Often the entire top edge of the heat sink is closed, providing no path for air to flow under the heat sink other than back out the bottom edge, which is usually open. Sides may be open or partially open, but the sides are much smaller than the top and bottom edges of the memory module, limiting the possible air flow. (Spec. para [0009])

Cipolla fails to recognize this problem, since Cipolla has a plugged top that blocks air flow. This is apparent from his Fig. 4, which shows frame 44 at the top that looks like plugs, preventing air flow out the top. Indeed, just as Applicant's specification notes, "often the entire top edge of the heat sink is closed". This is true of Cipolla, as his entire top is closed as is also seen in his Fig. 1.

Cipolla does provide apertures 22 for air flow, but as is apparent from his Fig. 1, these apertures 22 are not located on the top, but are located on the sides. Cipolla's front plate 34. Thus Cipolla teaches away, since he places air flow slots on the sides, causing a dead air space on the top. Cipolla could have provided a slot in his top frame 44, but he did not since Cipolla failed to recognize the problem that Applicant recognized. Others failing to recognize a problem is a secondary indication of non-obviousness, as is teaching away.

Ali Teach a Sealed Heat Sink, No Slots

Ali teaches a sealed heat sink, with no slots for air flow. No slots are visible in any of his drawings. Ali's embodiments shown in his figures show heat sink covers that encapsulate the memory chips. For example, a "flush contact" is made rather than a slot:

> In one embodiment, as illustrated in FIG. 2c when the top cover and bottom cover of the packaging are assembled (by being placed in flush contact with the circuit board or in contact with the opposing cover) a seal is formed encapsulating the memory chips and conductive gel within the package. (Ali, col. 3, lines 33-39)

Ali teaches that his memory chips are sealed and encapsulated by the top and bottom covers. Thus Ali teaches away from air flow under the heat sink or around the memory chip. Ali teaches away from the proposed combination.

Thus Cipolla teaches a dead air space by his frame 44 on top, while Ali teaches all dead air under his heat sink. The combination fairly teaches dead air at least on the top, or dead air everywhere under the heat sink.

Bottom Opening Missing

Claim 1 recites a bottom edge opening:

> a bottom edge portion that provides a bottom opening between the plate and the memory module for an entire length of a bottom edge when the plate is attached to the memory module, the bottom edge of the memory module containing metal contacts for making electrical contact to a memory module socket;

The bottom edge of the memory module substrate has the metal contacts that plug into the memory module socket. Claim 12 calls this the contact-side opening:

> a contact-side opening between the first heat-transfer plate and the substrate near the contactor edge of the substrate, the contact-side opening allowing air flow to the first plurality of memory chips;

Cipolla shows female connector 18 that circuit card 42 plugs into (Figs. 1, 4). At first glance it appears that there is a bottom edge opening in Fig. 4, since plates 34 seem to end above female connector 18. However, the curvy lines at the bottom of plates 34 are cut-off or continuation lines that indicate that only part of plate 34 is shown in the drawing. Fig. 1 shows no bottom opening near female connector 18. See Figs. 1 and 14, which show no bottom gap or opening between plates 34, 36 and female connector 18.

Indeed, rather than have an opening on the bottom, Cipolla teaches a narrowing or reduced cross-section near the bottom:

> The bottom portion of frame 44 is provided with a plurality of reduced cross-section regions 68 that allow the passage of the interconnection region of a flex circuit 52 therethrough. (Cipolla col. 4, lines 50-54)

Thus Cipolla fails to teach the "bottom opening" of claim 1, so Cipolla cannot render claim 1 obvious. Cipolla teaches a closed bottom edge or reduced cross-section near female connector 18, not a bottom opening.

Cipolla Has Horizontal Air Flow, not Vertical

There are apertures 50 on the back of Cipolla's Fig. 1 that are not visible in Fig. 1 that expel the "air flow" shown going into apertures 22. Thus Cipolla adds back-side apertures 50 rather than use a bottom opening for the air flow.

> A plurality of circuit carriers 46 are mounted in the interior of frame 44, positioned to allow unimpeded air flow between air flow apertures 22 in front cover plate 34 and air flow apertures 50 in rear cover plate 36. (Cipolla col. 4, lines 34-38)

Cipolla's air flow is from the front side to the back side, horizontally, while Applicant's air flow is vertical, from the bottom opening to the top-edge slots. Since the memory chips are also mounted vertically, Applicant believes that vertical air flow is superior to horizontal air flow since the air flows along the longer dimensions of the memory chips. Claim 12 mentions this enhanced heat-transfer:

> whereby heat-transfer is enhanced by air flow through the plurality of slots, past the plurality of memory chips, and through the contact-side opening.

Since neither Cipolla nor Ali have the claimed top-edge slots and bottom opening of claim 1, Cipolla and Ali cannot render claim 1 obvious. Cipolla teaches apertures on the sides, not on the top and bottom. Cipolla teaches horizontal air flow between his apertures 22, 50 on his front and rear cover plates 34, 36, which are not at the top and bottom. Thus Cipolla teaches away from the claimed top-edge slots and bottom opening. Cipolla fails to suggest the recited air flow of claim 1 since Cipolla's air flow is perpendicular to his plates 34, 36:

> the top-edge slots for allowing air flow underneath the plate between the plate and the substrate, from the bottom opening to the top-edge slots. (claim 1)

Top Attachment Missing from Cipolla

Applicant's claim 1 recites:

> top-edge slots formed near the top edge in the top attachment portion of the plate, the top-edge slots for allowing air flow underneath the plate between the plate and the substrate, from the bottom opening to the top-edge slots.

Claim 1 therefore recites that the claimed slots are formed "in the top attachment portion of the plate". The "top attachment portion" is for making contact with the top of the memory module substrate:

> a top attachment portion for making contact with a substrate of the memory module near a top edge that is opposite the bottom edge of the memory module; (claim 1)

Cipolla fails to teach or suggest that the slots are formed in a top attachment portion of his plate. Cipolla's plate 34 has apertures 22 formed therein (Figs 1,2). However, the cited plate 34 does not attach to the top of the memory module substrate. Instead, plate 34 is attached to frame 44 on the top, and frame 44 does **not** attach to flex carrier substrates 54, 56, as seen in his Fig. 4. Instead, there is a gap below frame 44 between the tops of memory module carriers 54, 56.

Thus Cipolla fails to teach or even suggest that the top-edge slots are formed near a top attachment portion. Cipolla is completely lacking a "top attachment portion" of the substrate. Instead, Cipolla teaches that the tops of his flex carriers 54, 56 are not attached. Cipolla teaches a complex Y-shaped attachment of the bottoms of flex carriers 54, 56 to the top of his circuit-board substrate 42 near 68 in Fig. 4.

Independent claim 19 recites:

> top attachment portion means, in the heat-sink means and along an opposite edge of the substrate means, for physically contacting the substrate means along the opposite edge;

Again, this top attachment portion means in the heat sink for physically contacting the substrate means is completely lacking in Cipolla.

Cipolla Adds Frame Around Free-Standing Tops of Flex Carriers

Since Cipolla explicitly teaches that the tops of his flex carriers 54, 56 (cited as the claimed substrate) are free-standing and not attached to his heat sink plate 34 or even to

his frame 44, Cipolla cannot render claims 1, 19 obvious, since there is no teaching or suggestion of a "top attachment portion" of the substrate as recited in claim 1.

Since Cipolla does not have any top attachment of the heat sink to the memory module substrate, Cipolla adds a frame 44. This is a complex addition, as seen by the two frames 44 in Fig. 2, one near the top and labeled on the top left in Fig. 2. Having to add such a complex and expensive frame 44 that Applicant does not include is another indication of non-obviousness, since Cipolla adds complexity and expense that Applicant has avoided.

Cipolla's Slots are on Flat Plate Sides, Not Top

Applicant attaches his heat-sink plates directly to the top of the substrate at the "top attachment portion". Claim 2 recites that this

> top attachment portion contacts the substrate for an entire length of the top edge of the substrate.

while claim 3 recites the alternative that the slots extend to the top edge:

> wherein the top-edge slots extend to the top edge, dividing the contact portions of the top attachment portion

Nowhere does Cipolla show his slots extending to the top edge of the substrate. Instead, his apertures 22 are located on the side plates 34, away from the top edge, as seen in his Fig. 1.

Ali fails to teach any slots at all. While Ali may have a sloping section of the heat sink, Ali, teaches a fully sealed heat sink without any internal air flow. So Ali completely fails to recognize the problem of dead air inside the heat sink and indeed teaches away by sealing to block any possible air flow. Combining Ali with Cipolla further teaches away from the invention, since Ali teaches no slots and a sealed heat sink.

Cipolla has Slots on "Planar Surface" not Sloping Section

Claim 9 recites that the slots are formed on a sloping portion of the plate:

> wherein the top-edge slots are formed on a sloping portion of the plate between the raised ridge and the top attachment portion.

Cipolla explicitly teaches that slots are formed on the planar or flat portion of his plate 34:

> Each heat sink is provided with air flow apertures formed in its planar surface and adjacent to each circuit chip. (Cipolla col. 3, lines 9-11)

Thus Cipolla explicitly teaches away from the proposed modification with Ali, since Cipolla teaches that slots are formed on the "planar surface" not on a curved surface, and not on frame 44. Indeed, Cipolla repeats "planar" over and over again in his abstract and summary, since Cipolla needs planar surfaces to stack modules together and so that his apertures 22, 50 align to each other when stacked.

Since Cipolla explicitly teaches away from a modification of slots on a sloping surface, the proposed combination of Cipolla and Ali is improper and cannot render claim 9 obvious. A combination of Cipolla and Ali would fairly teach only slots on a flat, planar surface, not slots formed on a sloping portion of the plate as recited in claim 9.

Cipolla's Slots In Wrong Location Relative to Memory Chips

Independent claim 12 recites an attachment portion of the heat-transfer plate, and

> a plurality of slots through the first heat-transfer plate between the attachment portion and a chip-contact portion of the first heat-transfer plate that makes contact with the first plurality of memory chips:

These slots are "between the attachment portion and a chip-contact portion of the first heat transfer plate that makes contact" with the memory chips. In contrast, Ali teaches a sealed design with no slots at all, and Cipolla teaches apertures 22 that extend downward along his chips 58.

> Chips 58 are connected to flex strip 54 using conventional surface-mount technology. Thus, a screened solder can be used and reflowed in an infrared conveyor oven. Other surface mount techniques are also useable herewith. During assembly, flex circuits 52 and 54 are packaged together with an interposed flexible elastomer sheet 56, to form a sandwich arrangement. They are then laid in frame 44, positioned such that they lie between apertures 22 and 50 in front cover plate 34 and rear cover plate 36 respectively. (Cipolla col. 4, line 64 to col 5 line 5)

Thus Ali and Cipolla cannot render claim 12 obvious, since the slots are either non-existent (Ali) or are in the wrong location. Cipolla's apertures 22 (Fig. 1) would have to be above his chips 58 in his Fig. 4 to be "between the attachment portion and a chip-

contact portion of the first heat-transfer plate that makes contact with the first plurality of memory chips" as recited in claim 12.

In view of the above, it is submitted that claims 1-20 are in a position for allowance. This application was filed with formal drawings that have not been amended. Applicant believes that a full and complete response to the office action has been made. Reconsideration and re-examination is respectfully requested. Allowance of the claims at an early date is solicited.

If the Examiner believes that a telephone interview would expedite prosecution of this application, the Examiner is invited to telephone the undersigned at (831) 476-5506.

Respectfully Submitted,

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